

**Remarks**

Applicant respectfully requests reconsideration of this application as amended herein.

An Abstract of the Disclosure has been attached as required by the Examiner. Applicant regrets the oversight in failing to include an Abstract with the application as filed. The attached Abstract of the Disclosure was actually filed with the PCT application but overlooked when the U.S. Application was filed.

Claim 11 has been objected to and rejected under 35 USC 112 for several technical defects. These defects have been corrected in this amendment. In addition, claim 11 has been amended to depend from claim 1 instead of claim 2 since HIP'ing is not necessary if hot forging is used, since both process steps perform similar functions.

Claim 9 has been rejected under 35 USC 103 as obvious over Tu. Tu discloses a medical instrument having a ball electrode 14 made of gold, platinum, silver, platinum, stainless steel, or Nitinol. Claim 9 has been amended to more clearly define the claimed article for use in a ball bearing. Tu does not teach the use of his ball electrode as a rolling element for a ball bearing, and Applicant does not believe that there is anything in any cited reference that would lead a person of ordinary skill in the art to use Tu's ball for that purpose. Accordingly, Applicant believes that claim 9 is allowable as amended.

Claim 10 has been rejected under 35 USC 103 as obvious over Goldstein. Goldstein discloses a lock shackle having a Nitinol rod 10 in the center of the composite shackle. Claim 10 has been amended to more clearly define the claimed article for use in a roller bearing.

Goldstein does not teach the use of his lock shackle rod as a rolling element for a roller bearing, and Applicant does not believe that there is anything in any cited reference that would lead a person of ordinary skill in the art to use Goldstein's rod for that purpose. Accordingly, Applicant believes that claim 10 is allowable as amended.

Claim 20 has been rejected under 35 USC 103 as obvious over Rouverol. Rouverol teaches a rolling contact element for bearings or traction friction drive devices. The essence of Rouverol's teaching is the use of precompression of the rolling contact surface. He does mention in passing that shape memory materials are well suited to shrink-fit assemblies, and that the disadvantage of non-hardenability of nickel-titanium alloys can be overcome by his prestressing techniques, which he discloses in great detail. In fact, Applicant has found that Type 60 Nitinol makes excellent bearing materials without prestressing. Applicant has attempted to claim this distinction in amended claim 20.

Claims 1, 5 and 7 have been rejected under 35 USC 103 as obvious over Rouverol, Hockin and James. Rouverol teaches the use of Nitinol rolling surface elements and prestressing elements, but not for the actually rolling elements themselves. The lines quoted by the Examiner confirm this fact.

Hockin discloses an investment casting process, but does not disclose that it can be used to cast Nitinol. In fact, to Applicant's knowledge, before his invention, no articles were ever cast using a casting process like Hockin's process. Applicant believes that, even though Nitinol was invented in the early 1960's, and Hockin's patent issued in 1966, the fact that nobody in the art, skilled or unskilled, ever tried to cast Nitinol balls is an indication that the process was unobvious to those skilled in the art.

Claims 3-4 have been rejected under 35 USC 103 as obvious over Rouverol, Hockin, James, Lothrop and Shih. Rouverol discloses rolling surface elements made of Nitinol, but the roller elements 131 themselves are made of steel. Rouverol is clear that Nitinol can be used only if it is compressively prestressed to give it the necessary characteristics for bearing contact elements. Thus, claims 3 and 4 are not made obvious by the combination of references since the basic teaching of a Nitinol rolling element is absent.

→ Claim 8 has been rejected under 35 USC 103 over Rouverol, Hockin, James, and Stickels. Stickels teaches a heat treating process for improving the rolling contact fatigue life of bearing elements made of low carbon, chromium steel, referred to generally as SAE 52,100. Applicant has invented a process to produce Nitinol balls for ball bearings that have a high hardness for and a very hard oxide surface on the balls. Applicant does not believe that Stickels process for heat-treating SAE 51,200 steel is relevant to his process for heat treating Nitinol. It is well known that heat treatments for particular materials are almost never applicable to other materials. There is noting in any cited reference that teaches the process for obtaining the characteristics that Applicant has obtained. Applicant denies that the process he invented "involves only routine skill in the art." In fact, Applicant has been able to achieve what nobody else has ever achieved. Applicant does not believe it is appropriate to cite a reference teaching a different process for use with a different material, and then brush off his claims for patentability by claiming that the differences could be discovered by exercise of only routine skill in the art.

Claims 12-15 and 17 have been rejected under 35 USC 103 as obvious over Rouverol in view of DeGaeta. Rouverol teaches bearing contact surface elements of precompressed Nitinol, but not the actual rolling elements. DeGaeta teaches the use of a grinding process for grinding cylindrical, cubical or other non-spherical shaped items into spherical shape. However, the

combination of Rouverol and DeGaeta does not teach making balls of Nitinol for rolling element bearings, since Rouverol does not teach the use of Nitinol rolling elements themselves, and Neither reference teaches the process of cutting Nitinol cubes from a rolled sheet of Nitinol to obtain the cubes, or the benefit of using Type 60 Nitinol as rolling elements in rolling element bearings in the first place. According, Applicant believes that claims 12-15 and 17 should be allowable over this combination of references.

Claim 16 (does the Examiner mean claim 15?) has been rejected under 35 USC 103 as obvious over Rouverol, DeGaeta, and Nielsen. Nielson is cited to teach the use of laser cutting and for the advantage of the absence of burrs. In fact, burrs are of no concern in the claimed process because the burrs grind off very easily and quickly. The real benefit of laser cutting is its speed and the very narrow kerf it makes, avoiding the waste of processes that produce a wider kerf. However, current laser cutting apparatus is expensive, so these advantages are offset by the lower cost of water jet cutting. In any case, the benefit cited by Nielson is of no consequence in Applicant's process. Moreover, Rouverol does not teach Nitinol rolling elements for ball bearings, and Nielsen does not teach that his laser cutting process will actually work to cut Nitinol sheet. Finally, it is known that Nitinol is adversely affected by even small amounts of absorbed oxygen, and Nielsen's process using oxygen in the gas could adversely affect the properties of the resulting Nitinol balls. If a person of ordinary skill in the art were to assemble the references that the Examiner has assembled and conceive of their use as the Examiner has proposed it (and Applicant very much doubts that a person of ordinary skill in the art would conceive of such a thing, as noted above) then this person of ordinary skill in the art would reject the use of Nielsen's laser because of the likelihood that the oxygen content of Nielsen's gas would be damaging to the desired properties of the Nitinol in the balls.

Claim 18 has been rejected under 35 USC 103 as obvious over Rouverol in view of Lothrop (and Sommer is also cited.) Claim 18 calls for a process for making Nitinol bearing races, including selecting a tube made of Type 60 Nitinol. Rouverol does disclose a roller bearing in his Fig. 13 having rolling surface elements 135 and 135 made of shape-memory materials that can be prestressed. However, Rouverol does not disclose how those elements can be made.

Lothrop teaches a process of drilling a bar A of material to make a tube B. The tube is then cut off in the form of annular rings D. The rings are then placed in a die and upset to cause the material to flow and conform to the desired conical shape of the roller bearing race.

There is nothing in Rouverol or Lothrop that would teach a person of ordinary skill in the art how to select a tube made of Type 60 Nitinol. In fact, tubes of Type 60 Nitinol are not available anywhere in the world. Applicant has disclosed one process for making tubes of Type 60 Nitinol, but to Applicant's knowledge, there are no type 60 Nitinol tube available to "select". Therefore, it would not be obvious to one skilled in the art to select a tube made of Type 60 Nitinol if such a tube is not available.

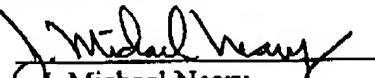
The process taught by Lothrop of drilling a bar of Type 60 Nitinol would not work. Type 60 Nitinol is nearly impossible to drill without the preparation taught by Applicant, and Type 60 Nitinol is not available in bar form. Thus, a person of ordinary skill in the art would not even begin to make the invention defined in claim 18 because the starter materials are not available and he would have no way of obtaining them. A person of ordinary skill in the art would not waste his time attempting to make something when the materials are not available, so the invention defined in claim 18 would be unobvious to a person of ordinary skill in the art.

Sommer teaches a method of centrifugal casting steel bearing races. Sommer does not teach making Nitinol races with the centrifugal casting process, or that Nitinol could be cast using that process, or any of the heat treating detail that are used to produce desirable properties in the resulting article. Thus, Applicant believes that Sommer is not an enabling teaching of the claimed process.

Claim 19 has been rejected under 35 USC 103 as obvious over Rouverol and Sommer in view of Stickels. Stickels teaches a process for heat-treating SAE 52,200 steel. Applicant asserts that the teaching would be known to a person of ordinary skill in the art to be applicable only to steel, and to SAE 52,200 steel in particular, and not to other materials, especially not to non-iron based materials. Thus, Stickels would not be regarded by a person of ordinary skill in the art to be an enabling teaching that would be applicable to Nitinol.

If the Examiner concurs with Applicant the claims of the application as amended herein and explained above particularly point out and distinctly claim the invention, he is respectfully requested to pass this application to issue.

Respectfully submitted,



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